UNIVERSITY OF PENNSYLVANIA

THE RELATIONSHIP OF PSYCHOLOGICAL TESTS IN THE FIRST GRADE TO SCHOOL PROGRESS: A FOLLOW-UP STUDY

THOMAS W. RICHARDS

A THESIS

IN PSYCHOLOGY

PRESENTED TO THE FACULTY OF THE GRADUATE SCHOOL IN
PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY

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THE RELATIONSHIP OF PSYCHOLOGICAL TESTS IN THE FIRST GRADE TO SCHOOL PROGRESS: A FOLLOW-UP STUDY

By T. W. Richards

Part I

Introduction and Scope of Investigation

In 1924 Easby-Grave [1] published the results of an investigation of 500 first grade children in Philadelphia. The object of her study was to determine standards for certain psychological tests at that age-grade level for purposes of clinical classification and diagnosis, and if possible by means of these tests, to throw new light on the problem of the first-grade child. The present study represents the attempt to follow up by means of school records those children in the Easby-Grave group of 500 who were at the time of her study in the Public Schools of Philadelphia, a group of 416 cases. The aim was to determine the accuracy of the test scores given at that time in predicting school progress, and, if possible, later intellectual status.

In each of the 416 cases an attempt was made (1) to trace the child's progress as far as possible through the Philadelphia schools, and (2) to obtain for each child the Intelligence Quotient given him when in the 6B (in the case of schools operating on the 6–3–3 plan) or in 8B (in the case of schools operating on the 8–4 plan). These Intelligence Quotients are derived from scores made on the Philadelphia Group Test of Mental Ability, and are used by the Philadelphia Schools for the purpose of classification of pupils into ability groups in the Junior and Senior High Schools throughout the city.

[1] C. Easby-Grave, Tests and Norms at the Six Year Old Performance Level. *Psychol. Clin.*, 1924, 15, 261–300.

As the result of investigating records throughout the school system 326, or 78 per cent, of the original 416 cases were traced. It was decided arbitrarily to limit the group to be used for purposes of correlation to those children who could be followed up through twelve semesters or more. The purpose was to establish in this way a criterion of progress in school covering a period of time which would be a fair indication as far as the individual was concerned, and which would fit more reasonably into a series of progress indices which might be continuous as far as the data would permit. This limitation reduced the number of cases to 229.

The data necessary for this investigation could not have been secured without the cooperation of the Philadelphia Schools. I wish to thank personally Dr. Parke Schoch for permission to examine the records of Junior and Senior High Schools throughout the city. To Dr. Philip A. Boyer I am deeply grateful for many suggestions as to method of investigation. It was due to his advice that the Philadelphia Group Test of Mental Ability was incorporated into the study. Dr. Morris S. Viteles was very kind in suggestions as to statistical treatment. I should like to thank Dr. Lightner Witmer for the opportunity of using the Easby-Grave data, and for permission further to investigate the results of work done under his direction by Dr. Easby-Grave. The Division of Special Education was very liberal in extending to me permission to use their files. My greatest debt of gratitude is to Dr. Miles Murphy, without whose interest and willingness on every occasion to give helpful suggestions this study would never have been completed.

School Progress

As an indication of progress in school, the Progress Index was used, which is described by Freden in his comprehensive study [2] of age-grade and progress statistics in the school systems of Iowa. This index for the individual case is obtained simply by finding the ratio of time spent in school to the amount of progress made in that time and multiplying this quotient by 100. Thus, a child who has passed through the 6B grade (B the high sixth, A the low) and who has been in school six years, or twelve terms, receives an Index of 100. The child who passes through 4B (eight semesters) in twelve semesters receives the quotient of 8/12 x 100, or 66.7, etc.

Fifteen, or 6.6 per cent of the group of 229 cases traced through

[2] G. Freden, Age-Grade and Progress Indices for the Public Elementary Schools of Iowa. University of Iowa Studies in Education, 1927, 4, No. 4.

twelve or more semesters of school, are excluded from the group correlated with the test scores given in the first grade because they spent at least some time in a special class for backward children (called in the Philadelphia Schools Orthogenic Backward Classes). In Table 1 appears the distribution of Progress Indices for the remaining 214 cases.

TABLE 1

DISTRIBUTION OF PROGRESS INDICES

Index	*Frequency*
60–66	9
67–73	12
74–80	18
81–87	25
88–94	71
95–101	57
102–108	16
109–115	5
116–122	1
No. of cases	214
Median	92.29
Average	90.68 ± .77
S.D.	11.27
Variability	12.43
Skewness	−.43

There seem to be no studies in the literature which meet the precise conditions of our experiment; no group could be located with which we might compare this distribution. Freden [3] reports the average index for elementary school children in the State of Iowa as 93.3 (or .933) for 38,144 cases. This index remains at 93.3 if we take the average for the 6,178 cases who have been in school for twelve terms or longer. Knight and Manuel [4] report an investigation of high school graduates in the Waco, Texas High School. These authors sought to determine the relationship between age of school entrance and subsequent school record. Their method was to determine the length of time graduates had spent in completing the eleven years required in that school system to graduate from high school. For the purpose of their experiment they classified the group of 103 cases according to sex and age of entrance. We took the liberty of determining the average for the entire group studied by Knight and Manuel and found it to be 11.32 years. The Progress Index for this group becomes, therefore,

[3] G. Freden, Age-Grade and Progress Indices for the Public Elementary Schools of Iowa. University of Iowa Studies in Education, 1927, No. 4.

[4] J. Knight and H. T. Manuel, Age of School Entrance and Subsequent School Record. *Sch. and Soc.*, 1930, 32, 24–26.

97.18. Our own average of 90.7 is not the index of average progress, but the average index for the group. It is seen to be lower than the averages either for a group composed entirely of elementary school pupils throughout Iowa (therefore more similar to our own group) or for a group composed entirely of high school graduates. Whether or not the differences between these averages are significant cannot be determined.

Figure 1 shows graphically the distribution of Progress Indices.

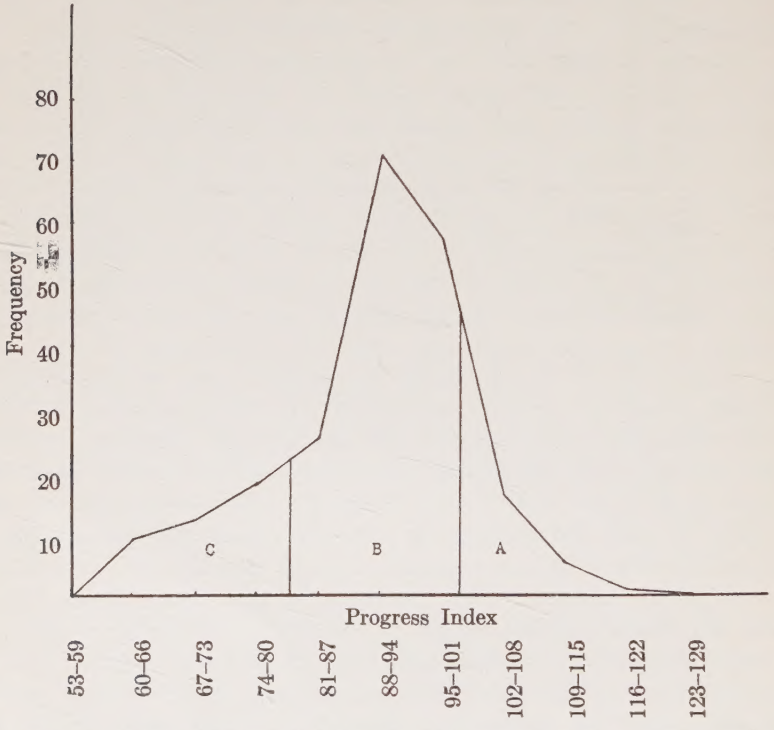

FIG. 1. Curve showing distribution of Progress Indices. The area of the curve is divided into three sections, to show the approximate portions of the area included by the Low, Middle and High Groups.

The fact that the average Progress Index is but 90.7 might indicate that the schools are rather more prone to retard children than to give them double promotions. If this is the case the tendency fits in with the theory that the retarded child is given educationally more consideration at present than is the accelerated child.

Philadelphia Group Test of Mental Ability

As mentioned above, an attempt was made in the investigation of records to obtain for each child the I.Q. given in 6B or in 8B, through the use of the Philadelphia Group Test of Mental Ability. I.Q.s for only 135 cases were obtained. These distributed as in Table 2.

Table 2

Distribution of Intelligence Quotients: Philadelphia Group Test of Mental Ability

I.Q.	*Frequency*
70–79	10
80–89	21
90–99	32
100–109	33
110–119	22
120–129	12
130–139	2
140–149	2
150–159	0
160–169	1
No. of cases	135
Median	101.52
Average	102.48 ± 1.39
S.D.	16.17
Variability	15.8
Skewness	−.18

Part II

Comparison of Follow-up Groups with Original First-grade Group of 500

In order to determine whether or not the groups followed up were selected, comparisons on the basis of first grade I.Q.s were made. For purposes of convenience, the group of 500 children tested by Easby-Grave will be referred to hereafter as E–G, the whole group followed up as Group I, the group of 214 cases followed up for whom Indices were computed as Group II, the group of 135 cases for whom 6B or 8B I.Q.s were secured as Group III, and the group of 13 cases[5] of special class pupils as Group IV.

Table 3 illustrates the distributions of I.Q.s for Groups E–G, I, II, III, and IV, with the average, median, standard deviation, variability and skewness of each. Using Pearson's[6] formula for

[5] After the groups had been isolated, it was found necessary to exclude two cases from Group IV, the OB group. The computations for the groups were recalculated.

[6] K. Pearson, Note on the Significant or Non-Significant Character of a Sub-Sample Drawn from a Sample. *Biometrika*, 1906–7, pp. 181–183.

TABLE 3

DISTRIBUTION OF EASBY-GRAVE I.Q.S, GROUPS E–G, I, II, III AND IV

I.Q.	Frequency				
	Group E-G	Group I	Group II	Group III	Group IV
40–49	1	0	0	0	0
50–59	2	1	1	1	0
60–69	5	1	1	1	0
70–79	29	8	8	7	0
80–89	56	18	14	7	4
90–99	80	33	31	17	2
100–109	133	65	57	34	7
110–119	108	62	62	44	0
120–129	64	33	32	18	0
130–139	13	3	3	2	0
140–149	7	5	5	4	0
150–159	1	0	0	0	0
160–169	1	0	0	0	0
No. cases	500	229	214	135	13
Median	105.8	108.3	109.22	110.23	101.0
Average	104.98±.74	107.4±.99	107.94±1.02	108.04±1.35	96.1±26.65
Standard Dev.	16.64	14.9	14.95	15.70	9.44
Variability	15.85	13.76	13.85	14.53	9.82
Skewness	−.15	−.18	−.26	−.42	−1.55

the computation of sigma differences between averages of group and sub-group, the differences between the averages of the smaller groups and that of the Easby-Grave group, with the reliability of these differences, are given in Table 4.

TABLE 4

DIFFERENCES BETWEEN AVERAGES OF I.Q. GROUPS: BETWEEN EASBY-GRAVE DISTRIBUTION OF 500 FIRST GRADE CHILDREN, AND SUB-GROUPS OF THOSE FOLLOWED UP

Groups	Difference	$\frac{\text{Diff.}}{\sigma \text{ diff.}}$	Favor
E-G and I	2.42 ± .750	3.23	I
E-G and II	2.96 ± .839	3.53	II
E-G and III	3.06 ± .971	3.15	III
E-G and IV	8.88 ± 2.65	3.35	E-G

The differences between the Easby-Grave group of 500 and each of the sub-groups are significant. The fact that the whole group of 229 cases followed up should differ so significantly from the Easby-Grave group is rather difficult to explain. The drop-file system in the Philadelphia Schools is designed to permit of quite as ready check-up on retarded children as on those who

progress normally or better, so that if the relationship between school progress and I.Q. is assumed pre-analytically, the criticism that we have here a selected group of brighter pupils because of the fact that they remain in school longer is unlikely. The only explanation we can give at present is based on the schools in which children for the Easby-Grave standards were tested. The group of 229 cases followed up were, when originally examined, in three Philadelphia Public Schools. The approximate percentages of the group of 500 cases secured by Easby-Grave in each of these three schools are listed below, with the percentages of our group of 229 secured from the same schools. The slight difference

	Easby-Grave 500	*229 followed up*
School A	48%	60%
School B	28%	23%
School C	16%	17%
Other Schools	8%	0%
Total	100%	100%

in percentages may account for some lack of balance in the selection of cases from different schools, although there is no evidence for this assumption. The fact that the group of OB pupils is composed of but 13 cases may suggest that statistical differences are unreliable. From the point of view of the process of selection which created it, however (largely mental deficiency and school retardation), the difference between its average and that for a normal group should be definite and significant.

Part III

Interrelationships of Tests within the Total Group Followed Up

The tests selected for correlation with school progress and with the I.Q. given in 6B and in 8B were (1) Stanford Revision of the Binet-Simon Scale (I.Q.); (2) memory spans, (*a*) auditory, (*b*) visual and (*c*) reverse; (3) performance tests, (*a*) Witmer formboard, and (*b*) Witmer cylinders. The group of 229 cases, Group I, was used in the intercorrelations.

The distribution of I.Q.s has been discussed in the foregoing paragraphs.

The distributions for memory span appear in Table 5. The auditory span appears to distribute about normally. In regard

TABLE 5
DISTRIBUTION OF MEMORY SPANS

Span	Auditory	Visual	Reverse
0	0	32	84
2	0	0	41
3	4	11	82
4	62	75	20
5	104	76	2
6	37	26	0
7	18	6	0
8	4	2	0
9	0	1	0
No. cases	229	229	229
Median	5.45	4.96	2.76
Average	5.57 ± .07	4.73 ± .11	2.69 ± .07
S.D.	.99	1.61	1.07
V	17.70	34.04	39.78
Skewness	+.34	−.43	−.18

to the visual and reverse spans, it was felt that the score of 0 was illegitimate, since it indicated not the total lack of ability tested, but the inability to give evidence of that ability on the test in question. If we adopt this theoretical viewpoint and discard all 0 " scores " from the distributions, the curve for the visual span assumes a more normal shape, though with a tendency to bimodality, at spans 4 and 5; the curve for reverse span closely approximates that of normal distribution.

The *Witmer formboard.* The most striking aspect of these distributions is the marked skewness. For purposes of greater clearness the curve has been drawn for the first and second trials, in Fig. 2. The close approximation to normal distribution at the negative end of the curve and the stretching out of cases at the positive end suggested the possibility of cutting the time limit for the test down to two minutes,[7] and correlating only those time scores under that limit. Accordingly, since there were but six failures on the first trial of the formboard they were counted as in highest step interval, while, in correlating the test as of a two minute time limit, failures were excluded, as in correlations with memory span.

[7] In order to preserve the step-intervals of the formboard (five minutes) distribution, the intervals for the two minute distribution were set as thirds of the larger groups. This made it necessary to extend the highest interval in the finer calibration to 124″. Since there were no cases in this interval of scores above 2′, it seemed legitimate to consider this a practical distribution of cases completing the test in less than 2′.

The *Witmer cylinders.* This distribution appears not to be normal, particularly in the first trial. Fifty-one per cent of the total group pass the cylinders on the first trial, 87 per cent pass the test on the second. Since the frequency of failure was so large on each trial, DNC scores were discarded in correlations. It would appear that the Witmer cylinder test, since it seems not to

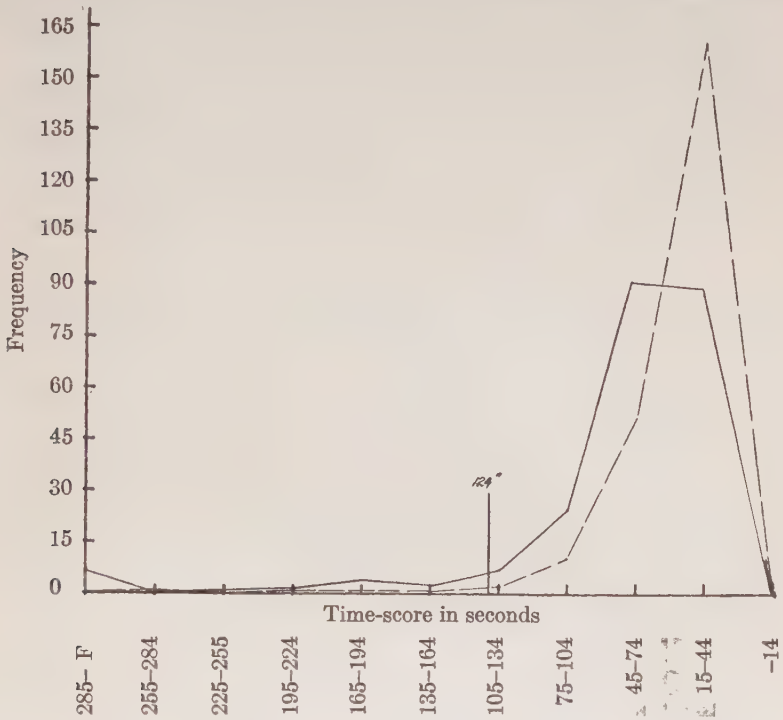

FIG. 2. Curve showing distribution of time scores for the Witmer form-board: Solid line 1st trial, dash 2nd. Line drawn at 124" to show effect of cutting time limit to 124".

distribute normally for first-grade children, is a poorly calibrated instrument when standardized for this age-grade level, insofar as quantitative measurement is concerned. The fact that it offers such a definite problem for these children, however, is further support for the opinion that it is a good test for qualitative clinical use.

In intercorrelating the tests, the Pearson formula for r was used with all data except those for the memory spans. In the case of memory spans, where the series is not continuous but discrete, and

the range narrow, it seemed advisable at first to use Pearson's coefficient of mean square contingency described by Rugg,[8] perhaps more clearly by Garrett.[9] In the course of the statistical computation, however, it seemed wisest to discard all coefficients thus obtained. Yule's[10] criticism that as the fineness of the classification is varied, the coefficients are not comparable one with the other, and the lack of comparability between *C* and *r* as well as between *C's* (since the number of cases also varied when 0 scores were omitted from memory span and DNC scores from cylinder correlations) seemed to justify such a step. The size of the coefficients of contingency obtained seemed to have slight relation to the scatter of cases, and in every case the coefficients of contingency were appreciably higher than the Pearson coefficients.

The correlations secured appear in Table 6. For the Witmer

Table 6

Pearson Coefficients Secured in Intercorrelations of Stanford-Binet I.Q., and Performance Tests

	r	*PE*
I.Q. with Witmer formboard 1st trial (5′)	+.230	± .042
I.Q. with Witmer formboard 1st trial (124″)	+.166	± .052
I.Q. with Witmer cylinders 1st trial	−.135	± .061
Witmer formboard 1st with 2nd (5′)	+.526	± .032
Witmer formboard 1st with 2nd (124″)	+.308	± .042
Witmer formboard 1st (5′) with Witmer cylinders 1st	+.067	± .062
Witmer formboard 1st (124″) with Witmer cylinders 1st	+.195	± .061
Witmer cylinders 1st with 2nd	+.289	± .059
Average of coefficients of intercorrelation	+.206	

formboard, there seems a slight relationship with I.Q., but the only coefficient of reasonable magnitude is that secured with second trial. The very slight correlation with the cylinders, together with the fact that the formboard seems to be a relatively easy test for these children, while the cylinders seem to be difficult for them, suggests that the tests at this level are measuring different abilities. In interpreting the coefficients found for the cylinders the facts must be kept in mind (1) that the cases used are selected, since they represent only the upper end of the distribution, and (2) there

[8] H. O. Rugg, *Statistical Methods Applied to Education.* Boston, Houghton-Mifflin, 1917, pp. 299–307.

[9] H. E. Garrett, *Statistics in Psychology and Education.* New York, Longmans Green, 1926, pp. 195–203.

[10] G. U. Yule, *An Introduction to the Theory of Statistics,* London, 1919, p. 66.

is little evidence that the cylinders distribute normally at this level, contrary to the assumption of normal distribution within the variables for the Pearson formula. It is for those reasons unlikely that these coefficients are of much significance and their magnitude is hardly indicative of relationship with any other test.

Coefficients of correlation between I.Q. and other tests are low. The abilities required to do well on the Stanford-Binet seem unrelated at this grade-level to those required in performance tests; the highest coefficient here obtained is but + .230, that with the five-minute formboard.

Memory spans. For the purpose of showing relative frequency among memory spans, tables of percentage relationships are given (Tables 7, 8, 9). The relationship is evident, but somewhat slighter

TABLE 7

PERCENTAGE RELATIONSHIP BETWEEN VISUAL AND AUDITORY MEMORY SPANS: PERCENTAGE OF TOTAL AUDITORY GROUP IN EACH VISUAL CATEGORY

Auditory	Visual								
	0	3	4	5	6	7	8	9	Total
3	75.0		25.0						100.0
4	19.4	11.3	51.6	14.5	3.2				100.0
5	8.7	1.9	35.8	41.4	9.6	1.9		1.0	100.3
6	18.9	2.7	2.7	43.2	27.0	2.7	2.7		99.9
7	5.6	5.6	16.7	33.3	22.2	16.7			100.1
8			25.0	50.0			25.0		100.0
Total	14.1	4.8	33.0	33.4	11.4	2.6	.9	.4	100.6

TABLE 8

PERCENTAGE RELATIONSHIP BETWEEN VISUAL AND REVERSE MEMORY SPANS: PERCENTAGE OF TOTAL REVERSE GROUP IN EACH VISUAL CATEGORY

Reverse	Visual								
	0	3	4	5	6	7	8	9	Total
0	31.0	10.7	39.3	16.7	2.4				100.1
2	4.9		51.2	36.6	7.3				100.0
3	3.7	2.4	22.0	51.2	13.4	6.1	1.2		100.0
4			15.0	25.0	45.0	5.0	5.0	5.0	100.0
5	50.0				50.0				100.0
Total	14.1	4.8	33.0	33.4	11.4	2.6	.9	.4	100.6

TABLE 9

PERCENTAGE RELATIONSHIP BETWEEN AUDITORY AND REVERSE MEMORY SPANS: PERCENTAGE OF TOTAL REVERSE GROUP IN EACH AUDITORY CATEGORY

Reverse	Auditory						
	3	4	5	6	7	8	Total
0	4.8	35.7	46.4	9.5	3.6		100.0
2		31.7	46.3	14.6	7.3		99.9
3		22.0	48.8	19.5	8.5	1.2	100.0
4		5.0	30.0	30.0	20.0	15.0	100.0
5				50.0	50.0		100.0
Total	1.8	27.3	45.8	16.3	7.9	1.8	100.9

than might be expected from tests which suggest by their very nature a high correlation.

Generally, it seems safe to state that the tests used by Easby-Grave at the first-grade level intercorrelate poorly. If the object in selecting a battery of tests is to measure by means of those tests different abilities, this purpose seems, empirically, to be fulfilled in the selection of the Witmer formboard and cylinders and the Stanford Revision of the Binet for first-grade children. Whether or not the memory span tests are closely related to the other tests used has not been determined. The spans themselves seem to be related to each other. Probably they measure an ability common to each test, though to what extent cannot be stated.

PART IV

THE RELATIONSHIP BETWEEN FIRST-GRADE TESTS AND SCHOOL PROGRESS

The results for Group II, or that group composed of 214 cases for whom Progress Indices were calculated, were used in correlating test scores given in the first grade by Easby-Grave with the criterion of school progress. The coefficients secured for the Stanford-Binet and the performance tests, appear in Table 10.

TABLE 10

PEARSON COEFFICIENTS INDICATING THE RELATIONSHIP BETWEEN SCHOOL PROGRESS AND FIRST-GRADE PSYCHOLOGICAL TESTS

	r	*PE*
School progress with I.Q.	+.413	± .039
School progress with Witmer formboard, 1st trial (5′)	+.069	± .046
School progress with Witmer formboard, 1st trial (124″)	+.165	± .047
School progress with Witmer cylinders, 1st trial	−.024	± .065

It will be seen that the relationship as demonstrated by the coefficients between school progress and time scores on performance tests is negligible. The coefficient of + .413 secured in correlating the Stanford-Binet with school progress suggests a definite positive relationship, although not of high degree.

Seeking further to study the relationship between school progress and the tests used by Easby-Grave at the first-grade level, a method was devised by which the group was divided into three sub-groups, on the basis of Progress Indices. Those children who progressed normally or better (had Indices of 100 or more) were considered the high group (Group A). Group C, or that group which made the slowest progress through the grades, was formed by taking those cases who were as inferior in Index to the average for the group (90.7) as those with Indices of 100 or better were superior to it. The groups as divided on the basis of Progress Index, with the number of cases and percentage of that number in each, were as follows:

Group A (superior group) 74 cases; 35%; Indices of 100 plus.
Group B (middle group) 97 cases; 45%; Indices from 81.4 to 100.
Group C (inferior group) 43 cases; 20%; Indices of 81.4 minus.

Figure 1 illustrates in a graphic way the area of the total curve for school progress included by each of these groups. In terms of school progress, roughly we can say that Group A is composed of those children who completed ten grades in twenty semesters or less; Group C is composed of those children who in about twenty semesters were able to complete eight grades or less. Between the two groups is a group of children (Group B) who vary in rate of progress roughly between Indices 80 and 100.

The distributions of Groups A, B and C for the I.Q. appear in Table 11. The results for memory spans and performance tests are not tabulated but the reliabilities of the differences between the groups in these tests are shown in Table 12. The difference should be regarded as reliable if the ratio of the difference between two averages to its sigma is above 3, since there is for such a ratio practical certainty that it exists (or is greater than 0). Those differences which seem actual have been indicated by an asterisk, on the basis of probability of their occurrence.

The findings in regard to differences between Groups A, B and C should be interpreted very cautiously. There is much overlapping on all tests, least marked, perhaps, on the I.Q., greatest on the performance tests. For I.Q. the differences are more reliable

TABLE 11

SHOWING DISTRIBUTION OF STANFORD-BINET 1ST GRADE I.Q.S FOR THREE GROUPS OF SCHOOL PROGRESS INDICES

I.Q.	Frequency		
	Group A, High Group	Group B, Middle Group	Group C, Low Group
50–59	0	1	0
60–69	0	0	1
70–79	0	3	5
80–89	0	9	5
90–99	6	16	9
100–109	16	26	15
110–119	27	28	7
120–129	20	12	0
130–139	1	2	0
140–149	4	0	1
No. cases	74	97	43
Median	115.56	107.55	101.0
Average	115.54 ± 1.35	106.03 ± 1.45	98.72 ± 2.34
S.D.	11.62	14.29	15.33
V	10.06	13.48	15.54

TABLE 12

INDICATING $\frac{\text{Diff.}}{\sigma \text{ Diff.}}$ VALUES FOR THE VARIOUS GROUPS OF PROGRESS ON THE BASIS OF DISTRIBUTIONS OF 1ST GRADE TESTS

Test	Between A and B	Between B and C	Between A and C
Stanford-Binet	5.11 *	2.66	6.44 *
Memory Spans			
Auditory	.73	2.22	2.68
Visual	2.87	1.22	3.41 *
Reverse	2.87	.78	3.24 *
Performance Tests			
Witmer formboard	1.43	.60	.66
Witmer cylinders	1.71	1.05	.29

Note: Asterisk indicates difference is reliable.

than for any other of the tests. Differences between groups for the memory span are real, though not as reliable as those for the I.Q. As one might expect, for I.Q. and memory spans, differences between Groups A and C are more significant than those between A and B or B and C. There seem to be no reliable differences between averages for groups in the performance tests. (It must be remembered that these tests, particularly the cylinders, do not seem

to distribute normally at this grade-level. The statistical measures secured therefrom should, therefore, be interpreted with caution.)

In general, the results of the statistical analysis of differences among groups of children separated on the basis of school progress seem to bear out the tendencies demonstrated in the coefficients of correlation already secured. The I.Q., which correlates best with the Progress Index, differentiates best for superiority in school progress. Memory spans seem to differentiate better than do time-scores on performance tests, which for our groups differentiate not at all.

There seems to be little in the literature with which we might compare the results secured in this part of our study. Ziegler,[11] in studying the relationship between attendance and various factors of school progress, placed seventh grade pupils in one of eight groups formed in terms of semesters overageness or underageness.

> "before these pupils entered this grade, they had been given the Illinois Intelligence Test. The results of this test combined with grades made in the Hillegas Composition Test were used to place pupils in that one of nine divisions to which the scores of these tests entitled them."

Between the factors of " ability " thus measured and amount of acceleration or retardation in the seventh grade in Junior High School for 307 cases he found a Pearson coefficient of $+ .17$, the probable error of which he does not present, but which appears to be for his group $\pm .037$. This figure cannot, strictly, be compared with our own coefficient. Freden[12] found the correlation between indices calculated on the basis of age-grade status and according to the method we have here used (ratio of time to progress) to be:

> "—.0652, which indicates that they should not be used interchangeably. Average progress is one thing and overageness another, each being seemingly independent of the other. Average progress means the amount of progress for each semester, or the rate at which children pass through a school system. Average overageness is the weighted average of the overageness for the various grades."

Toops and Pintner[13] found a positive relationship between age-grade status and intelligence, working with a large group of children and using a series of mental tests. They divided their data into four classes: school retarded and below median in mentality,

[11] C. W. Ziegler, School Attendance as a Factor in School Progress. *Teach. Coll. Contrib. to Ed.*, No. 297, 1928, p. 63.

[12] G. Freden, *loc. cit.*

[13] H. A. Toops and R. Pintner, Mentality and School Progress, *Jour. Educ. Psychol.*, 1919, 10, 253–262.

school retarded and above median in mentality, school advanced and below median in mentality, and school advanced and above median in mentality. They found an association coefficient by using Yule's formula,[14] of + 85. This coefficient is of course not comparable to our own, but suggests a positive relationship, which suggestion is borne out for I.Q. and perhaps for memory spans in our own study.

Hart,[15] using our own method of calculating the index of progress showed the graphic relationship between intelligence and school progress to be obliquely S-shaped.

> ". . . mental test ability . . . was determined from the results of Army Alpha National Intelligence and Stanford Binet tests. Some . . . took only the Alpha test; others took some combination of two of the three tests, and some . . . took all three. The results were reduced to quotients showing the mental-test achievement relative to the norm for the age."

He reports for this scatter a Pearson coefficient of + .84.

St. John,[16] although he did not use indices of any sort for school progress, calculated the number and percentage of children in each of three groups who had had four years of schooling—special class pupils, repeaters and special class pupils, and children who gained one year, in terms of I.Q. groups. A composite I.Q. derived from scores on the Stanford-Binet, Dearborn A and C (performance tests), Otis, and Myers Test was used. He used the results of a group of more than 700 children who had had but the first four years of school. His results would justify him in stating that

> "The data on the general relations between I.Q. and progress through the grades show consistently and unmistakeably a positive correlation. Pupils with high I.Q.s are almost the only ones who succeed in gaining a grade or a half grade during the four years of record. Almost all pupils who repeat grades, and all who are assigned to special classes, have low I.Q.s. Relatively few pupils of average I.Q. and none above average become, during the period of record, retarded or overage in grade; and those who become accelerated by skipping grades, with very few exceptions, have high I.Q.s."

Interpreting our own findings in relation to those mentioned above, it must be kept in mind that none of these studies was of

[14] G. U. Yule, *Theory of Statistics*, 1912, London, Griffin, pp. 37–39.

[15] H. Hart, School Progress and Mental Test Ability. *Sch. and Soc.*, 1925, 21, 181–182.

[16] C. W. St. John, Educational Achievement in Relation to Intelligence. *Harv. Stud. in Educ.*, 1930, 15, Cambridge, Harv. Univ. Press.

a follow-up character. The Easby-Grave tests were given when those in the group followed up were in the first grade, while the intelligence tests given in each of these other studies were (with the exception of St. John's and for a few of Hart's cases) group tests, given slightly prior to the time when the child had reached that point in school from which his progress to date was calculated. The fact should be considered that in almost every study made of the subject, the constancy of the I.Q. has been found to be *relative*. With our group of 135 cases the coefficient of correlation between school progress and the Philadelphia Group Test of Mental Ability, given at a period slightly before the calculation of indices and thus more comparable to the results of the studies mentioned above was $+ .554$ P.E. $\pm .040$.

To conclude the statistical analysis of data related to the problem of the relationship between tests in the first grade and subsequent school progress, it seems safe to state:

(1) That there is a positive relationship between score on the "intellectual" tests,—the Stanford-Binet and the memory spans—and school progress in terms of the ratio of accomplishment to the time allowed for such accomplishment.

(2) The correlation between performance tests scores and the Progress Index is negligible. Evidently, the ability required for successful progress through the grades is not measured in the first grade by the Witmer formboard and the Witmer cylinders, although reliability of the statistical measures secured for the performance tests may be lowered by the skewness of their distributions at this grade-level.

(3) The findings of this section seem to agree generally with those of other investigators.

(4) Although there is an actual correlation between first grade I.Q. and memory span tests, and school progress, the use of the tests as sole indices for purposes of predicting school progress should be extremely cautious.

Part V

The Relation Between First Grade Tests and the Results of the Philadelphia Group Test in 6B and 8B

We shall deal summarily with the results secured in this part of the experiment. In dealing with the data regarding the relationship between results of psychological tests at the first grade

level and those secured in the higher grades, certain factors concerning the raw data should be kept in mind.

(1) Although the I.Q.s derived from test scores on the Philadelphia Group Test of Mental Ability (referred to hereafter as PTMA) were made by children when in either 6B or 8B and not at a constant chronological age, the comparison with Stanford-Binet I.Q.s given in the first grade should be suggestive, since the data in the first grade were also secured with regard to grade rather than age constancy.

(2) I.Q.s for the PTMA are the result of a group test, and are being compared with those for an individual test.

(3) The group of children who receive I.Q.s on the PTMA is representative only of those children who pass through the 6A or 8A grades, and should, from the point of view of school standing, be regarded rather more as a Junior High School Group than an elementary school group.

The Pearson coefficients secured in correlating the PTMA with the Stanford Binet and performance tests appear in Table 13.

TABLE 13

COEFFICIENTS OF CORRELATION SHOWING RELATIONSHIP BETWEEN I.Q. GIVEN IN 6B AND 8B ON THE PTMA WITH SCORES ON FIRST-GRADE TESTS

PTMA I.Q. with Stanford-Binet I.Q.	$r = +.585$ P.E. $\pm .038$
Regression of X (PTMA) on Y	$\eta = .631$, corrected $= .604$ P.E. $\pm .038$
Regression of Y (S-B) on X	$\eta = .653$, corrected $= .628$ P.E. $\pm .036$
PTMA with performance tests	
Witmer Formboard 1st trial (5′)	$r = +.157$ P.E. $\pm .057$
Witmer Formboard 1st trial (124″)	$r = +.083$ P.E. $\pm .064$
Witmer Cylinders 1st trial	$r = +.104$ P.E. $\pm .086$

Below appears a table of the significant measures for each distribution.

	1st grade Stanford-Binet	*6B–8B grade PTMA*
Median	110.23	101.52
Average	108.04 ± 1.35	102.48 ± 1.39
S.D.	15.70	16.17
V	14.53	15.8
Skewness	−.42	+.18

The difference between the averages, 102.48 and 108.04, is 5.56, with a P.E. of ± 1.309. The difference appears to be a fairly reliable one, and in favor of the first grade. Variability of I.Q. is seen to be slightly greater at the upper grade level.

Although the results of this part of the investigation fall within the discussion of the constancy of the I.Q., certain features merit

consideration of extreme caution both in the interpretation of the data here presented and in comparison with the findings of other investigators within this field of interest. It may be reemphasized in this connection that here we are using the I.Q.s secured on two different measures. Most of the studies in the constancy of the I.Q. use measures secured on the same test. In addition, the interval between the tests in this study was extremely varied. Since the object of this experiment was not primarily to investigate the constancy of the I.Q., no attempt was made to control many of the factors which as Foran [17] points out in his excellent review of the literature in regard to the constancy of the I.Q., undoubtedly influence the reliability of this measure over a period of time.

It is interesting to note the relationships, on the one hand, between intelligence, as tested by the Stanford-Binet in the first grade and the PTMA in the sixth and eighth grades, and school progress, and, on the other hand, that between the two measures of intelligence. The coefficients named, in relation to each other, are as follows:

1st grade I.Q. with school progress	$r = +.413$ P.E. $\pm .039$
6th–8th grade I.Q. with school progress	$r = +.554$ P.E. $\pm .040$
1st grade I.Q. with 6th–8th grade I.Q.[18]	$\eta = +.604$ P.E. $\pm .038$
	$\eta = +.653$ P.E. $\pm .036$

Although the I.Q.s received in both the first grade and the sixth and eighth grades are related to school progress over a period of twelve semesters or more, the sixth and eighth grades I.Q.s appear to relate more closely. Neither of the I.Q.s, however, seems to relate as closely to school progress as these I.Q.s relate to each other. The indication is that though the tests of intelligence used in this study measure in some degree the abilities required to progress through the grades, they measure additional factors not implied in school progress.

The conclusions to this part of the investigation would appear to be as follows:

(1) There is an actual relationship between the I.Q. given in the first grade on the Stanford-Binet and that given in the 6B and

[17] T. G. Foran, A Supplementary Review of the Constancy of the Intelligence Quotient, Cath. Univ. of Amer., Educ. Res. Bull., 1929, 4, No. 9.

[18] Compare the coefficient of $+.70$ secured by Farson. M. R. Farson, A Report on the Examination of One Hundred 6B Children in Philadelphia Schools. *Psychol. Clin.*, 1928, 17, 128–152.

8B grades on the Philadelphia Group Test of Mental Ability. The coefficient secured when the tests are correlated indicates slight predictive value for the first grade test.

(2) The relationship between the 6B and 8B test and the first grade test is greater than that between either test and school progress over twelve or more semesters of school.

(3) There is a difference of approximately 6 points between the average for the I.Q. in the first grade and that for 6B and 8B. This difference appears to be a true one.

(4) The I.Q. secured on the group test in 6B and 8B appears to be slightly more variable than that secured on the individual test in the first grade.

(5) These findings are not strictly comparable to those found in studies of the constancy of the I.Q. because no attempt was made so to control conditions as to eliminate factors other than growth of the abilities measured by the tests. Again, neither the age at which I.Q.s were given in either case, nor the variation in interval between the tests were held constant. In addition, as Part I has indicated, the group here used is a small one, slightly superior in first-grade I.Q. Finally, two different measures of "general intelligence" were used in this study.

(6) Undoubtedly factors such as language handicap, unequal environmental conditions, attendance in school, and the like, which have received no consideration in this investigation, have tended to lower the reliability of the correlations between first-grade test results, school progress and later mental status.

Part VI

Studies of Special Class Pupils

It will be recalled from the discussion in Parts I and II that thirteen children in the total group followed up were placed ultimately in special class. As no index for most of these children could be secured (since in an OB class there is no grade standing), they were placed in a group by themselves (Group IV).

Certain material regarding the examination by Easby-Grave and those given later by the Division of Special Education is presented in case study form in some detail in Table 14. In the first column of the table appear the results of the Easby-Grave examination, with any supplementary remarks of a qualitative sort which

were at that time recorded. In the five columns to the right appear the follow-up data secured.

It is extremely difficult to draw conclusions of a general nature from the material in Table 14. Because the group was composed of thirteen cases, statistical calculations are practically worthless. It will be noticed, however, that there is a preponderance of children of foreign born (undoubtedly foreign speaking) parents. Of the thirteen, four of the children are from Italian families, two from German families, and one each from Hungarian and Russian families, although the child of Russian parents proved to be of a type definitely superior. Two of the children are girls; the remaining eleven are boys. The majority of the children became OB pupils because of "limited mental ability and school retardation." Three and possibly four were thus classified largely for restoration purposes. Eleven of the children had either dropped out of school because they had reached the age of sixteen, or were in OB until the close of the investigation. One child (the superior boy) spent only one term in OB, and at the close of the study was in 10A, one year ahead of schedule, while another was transferred from OB to a disciplinary class.

A comparison of test results, both quantitative and qualitative, between the original examination and those by the Division of Special Education indicates, above all, the lack of harmony between conclusions made. No one of the thirteen children was reported in the first grade study as being especially inferior or superior. This undoubtedly was due as much to the nature of the examination in the first grade as to the lack of similarity between the clinical pictures of the individuals tested. The first grade examination was made for the purpose of standardizing test results. As a consequence the aim was not to make a clinical study of the individual child, well though it might have been. The material presented in this part of our study would indicate that the type of examination conducted when the children were tested in the first grade is not conducive to the obtaining of accurate clinical data, useful from the point of view of prognosis. The indication is that there should be much more research of a clinical, individual nature in respect to those children who need special attention in school, before conclusions as to the prognostic nature of tests as such can be validated.

TABLE 14

Case	1st Grade Examination	Age Entered and Grades Repeated before OB Placement	OB Placement Grade, Age, and Term OB	Reasons for OB Placement	Examinations by Division of Special Education	Notes on Examinations and Supplementary Remarks
(1) B.J. Italian parentage. Male. White.	Grade I-B C.A. 8–9 M.A. 7–3 I.Q. 83 Aud. 6 Vis. 6 Rev. 4 W.F.B. (1) 30 (2) 41 W.Cyl. (1) 115 (2) 185	Entered I-A: C.A. 6–7 I-A, 1-A, 1-B, 2-A, 2-B, 4-A	When in 4-B. C.A. 13–4. Remained until 16, then dropped out of school.	Limited mental ability and school retardation	C.A. 13–4 (4B) M.A. 9–0 I.Q. 68 Aud. 5 Vis. 6 Rev. 3 W.F.B. (1) 24″ (2) 17″ H-A (1) 146″ (2) 17″ D.F.B. (1) F School Profic: Reading 4A Geog. 4A Arith. 4B Spelling 2A History None	Italian home, undoubtedly a language handicap. Poor intellectual ability. Somewhat higher type socially than usual case in Italian families. Very slow. Inferior comprehension. Very poor knowledge of history and geography.
(2) C.J. Italian parentage. Male. White.	Grade IB C.A. 8–1 M.A. 6–6 I.Q. 80 Aud. 5 Vis. 4 Rev. 0 W.F.B. (1) 42 (2) 30 W.Cyl. (1) F (2) 40	Entered 1A: C.A. 6–9 1A, 2A	When in 3A. C.A. 10–1. Remained to close of investigation.	Limited mental ability	C.A. 9–11 (3A) M.A. 6– 9 I.Q. 68 Aud. 5 Vis. 5 Rev. 3 W.F.B. (1) 29 (2) 28 (3) 23 H-A (1) 133 (2) 14 (3) 15 (4) 10 School Profic: Reading—not 1A Spelling 1B Arithmetic —	Very slow, lacked comprehension, initiative, efficiency. Needed drill in reading and spelling.

TABLE 14—*Continued*

					C.A. 15–4 (OB) M.A. 8–3 I.Q. 53 Aud. 5 Vis. 6 Rev. 4 W.F.B. (1) 26 (2) 21 (3) 15 H-A (1) 25 (2) 8 (3) 7 D.F.B. (1) 240 (2) 146 (3) 99 School Profic: Reading 1B Spelling 1B Arith. 4A	Home situation of interest: C helped his rheumatic father daily to buy and huckster fruit, necessitating a very early hour of rising and hence a long day. It seemed unlikely that the boy could progress further in school, and that for him to leave school and work might be advisable, not at the employment his father could provide, but at a "low type" factory job with regular hours. We did not learn whether or not this recommendation was followed.
(3) R.M. Italian parentage. Male. White.	Grade 1B C.A. 7–4 M.A. 7–6 I.Q. 102 Aud. Vis. Rev. W.F.B. (1) (2) W.Cyl. (1) (2)	Entered 1A: C.A. 5–5 1A, 1B, 2A, 5A	When in 6A. C.A. 13–5. Remained to close of investigation.	Needed definite individual drill in vocabulary-building, practice in reading, considerable work in oral English, some geography, some U. S. history.	C.A. 13–5 (6B) M.A. 9–7 I.Q. 71 Aud. 5 Vis. 7 Rev. 5 W.F.B. (1) 28 (2) 17 (3) 20 H-A (1) F (2) 9 (3) 7 D.F.B. (1) 188 (2) 136 (3) 64	Italian home. Undoubtedly language handicap throughout. Boy seemed quick, alert, hyperexcitable, nervous, perhaps a tic. Some trainability and efficiency, but poor ability to deal with abstract ideas. Very limited intellectual ability.

Note: For abbreviations in Table 14: C.A. chronological age; M.A. mental age; Aud., Vis., and Rev. memory spans; W.F.B. Witmer formboard; W.Cyl. Witmer cylinders; H-A, Healy A; D.F.B. Dearborn formboard (Witmer modification); OB, orthogenic backward, or special class for backward children. School proficiency is measured by use of the Philadelphia Public School proficiency test. Unless otherwise indicated, the Stanford-Binet was used in securing I.Q.

TABLE 14—*Continued*

Case	1st Grade Examination	Age Entered and Grades Repeated before OB Placement	OB Placement Grade, Age, and Term OB	Reasons for OB Placement	Examinations by Division of Special Education	Notes on Examinations and Supplementary Remarks
(4) N.L. Italian parentage. Male. White.	Grade 1A C.A. 5–10 M.A. 4– 9 I.Q. 81.4 Aud. 3 Vis. Could not read Rev. 0 W.F.B. (1) 62 (2) 90 W.Cyl. (1) 151 (2) 127	Entered 1A: C.A. 6–8 1A, 1B, 2A, 5A, 6A (which was eliminated by going to summer school)	When in 7A. In OB at close of investigation.	Seemed wholly unwise to continue him in junior high school. Intellectually inferior, poor language ability. Very poor ability in reading and spelling.	C.A. 14–4 (OB) (7A a few days before) M.A. 9–9 I.Q. 68 Aud. 5 Vis. 6 Rev. 4 W.F.B. (1) 25 (2) 21 (3) 14 H-A (1) 29 (2) 6 (3) 44 D.F.B. (1) 115 (2) 133 (3) 44	Inferior memory spans, poor language ability, undoubtedly influenced by Italian home. Inferior 3rd grade work, even when in 7A. Arithmetic fairly good. Needs much drill. Works well with hands, speedily and demonstrating recognizable ability to improve. Little planfulness. In appearance dirty and careless. No interest in school. Helps father in grocery store.
(5) N.L. Russian parentage. Male. White.	Grade 1B C.A. 6–8 M.A. 7–0 I.Q. 105 Aud. 5 Vis. 4 Rev. 3 W.F.B. (1) 45 (2) 31 W.Cyl. (1) 158 (2) 118 Good control, interest. General information good.	Entered 1A: C.A. 4–11 4B	When in 4B. Spent only 1 term in OB at 12–9	Although his school proficiency was much beyond his age level, it was recommended that he be placed in OB because of a seeming inability to concentrate, despite very good intellectual ability.	C.A. 8–7 (4B) M.A. 12–9 I.Q. 151 Aud. 5 Vis. 6 Rev. 4 W.F.B. (1) 46 (2) 40 (3) 27 H-A (1) 132 (2) 112 (3) 20 School Profic.: Reading 5th Spelling 5A Geog. 4th Hist. 4th	School progress not retarded before or after placement in OB. When investigation closed he was in 10th grade of a Philadelphia High School, having spent one year in the Temple University Junior High School, one year ahead of schedule. When in the 4th grade the boy seemed to have "mind and ability, but refuses to exercise either." He required more of the teacher's time than she could afford to give him, and obviously required special attention. The boy

TABLE 14—*Continued*

					C.A.		12–8
					M.A.		16–0
					I.Q.		126
					Aud.		7
					Vis.		7
					Rev.		6
					H-A	(1)	20
						(2)	14
						(3)	8
					D.F.B.	(1)	106
						(2)	61
						(3)	64

needed observation and pushing. Psychiatric examination soon after the special education examination showed the boy to be superior, and warning was given that unless he was treated properly he might be the object of much teasing from his schoolmates. Private school was recommended.

OB placement was successful in that it stimulated the boy.

At this examination L appeared bright, alert and well informed. He seemed of "good normal mentality, capable from the intellectual standpoint of maintaining a high degree of work in regular class. He had an excellent vocabulary, was extremely observant and handled both abstract and concrete material with great ability. Much initiative and energy were shown (probably misdirected in the classroom)."

He attended summer demonstration school at the University and did very good work. The following year was spent in the Junior High School at Temple University. At close of investigation he was in 10A in a Philadelphia high school.

TABLE 14—*Continued*

Case	1st Grade Examination	Age Entered and Grades Repeated before OB Placement	OB Placement Grade, Age, and Term OB	Reasons for OB Placement	Examinations by Division of Special Education	Notes on Examinations and Supplementary Remarks
(6) G.A. Hungarian parentage. Male. White.	Grade 1B C.A. 7–11 M.A. 8– 0 I.Q. 101 Aud. 6 Vis. 5 Rev. 5 W.F.B. (1) 56 (2) 32 W.Cyl. (1) F (2) F "Dirty—better than he looks. Never be anything special. Just an ordinary boy."	Entered 1A: C.A. 5–8 1A, 1A, 1B, 1B, 2B, 3A, 3A, 3B	When in 4A; C.A. 13–1. Has remained OB until close of investigation.	Because over age for grade and in need of special attention.	C.A. 12–5 (4A) M.A. 11–1 I.Q. 89 Aud. 7 Vis. 6 Rev. 3 W.F.B. (1) 45 (2) 25 (3) 34 H-A (1) F (2) 10 (3) 8 D.F.B. (1) 290 (2) 172 (3) 208	Boy had much initiative, energy, poise, was pleasant and alert. Needs drill in reading and spelling to improve phonic analysis; needs encouragement and "habit training."
				Physically unfit for 5th grade, mentally retarded, should be retained in OB.	C.A. 12–5 (4A) M.A. 11–1 I.Q. 89 Aud. 7 Vis. 6 Rev. 3 H-A (1) F (2) 10 (3) 5 D.F.B. (1) 320 (2) 325 (3) 100	Appeared to have specific difficulty with reading and spelling. Vocabulary poor. Use auditory field in teaching him.

TABLE 14—*Continued*

					Sch. Profic.: Reading 4B Spelling 3A Geog. & Hist. 5B C.A. 16–2 M.A. 13–3½ I.Q. 83 M.A. (Morgan Mental Ability) 13.5 Aud. 7 Vis. 6 Rev. 3 W.F.B.(1) 32 (2) 18 H-A (1) 27 (2) 6 (3) 8 D.F.B. (1) 230 (2) 115 (3) 125 Sch. Profic.: Reading 5th Spelling 4A Geog. & Hist. 6th Arith. o.k.	Now in the OB center. The boy seemed well placed. It was recommended that he remain for the next few months, then leave as he planned to do, and go to work. Some suggestion of emotional instability, perhaps a more serious nervous disorder. Follow-up, was not filed on records.

TABLE 14—*Continued*

Case	1st Grade Examination	Age Entered and Grades Repeated before OB Placement	OB Placement Grade, Age, and Term OB	Reasons for OB Placement	Examinations by Division of Special Education	Notes on Examinations and Supplementary Remarks
(7) D.F. German parentage. Male. White.	Grade 1A C.A. 6–9 M.A. 7–0 I.Q. 104 Aud. 5 Vis. 4 Rev. 0 W.F.B. (1) 35 (2) 40 W.Cyl. (1) F (2) F "Little initiative, though willing. Intelligence much better than intellect. Very cooperative."	Entered 1A: C.A. 6–5 1A, 2A, 3A, 3B	When in 3B; C.A. 11–3. Remained for two years, then sent into 4A disciplinary class.	Limited mental ability and school retardation. Needed individual attention.	C.A. 11–3 (5B) M.A. 9–0 I.Q. 80 Aud. 6 Vis. 7 Rev. 3 W.F.B. (1) 28 (2) 22 D.F.B. (1) 276 (2) 152 H-A (1) F (3′) (2), (3), (4) o.k. School Profic.: 3rd grade	A lazy boy who makes careless mistakes. Shows little effort. When pushed he does better work. Fairly good learning ability. Poor in dealing with abstract material. At C.A. 13–7 was recommended for and given disciplinary class placement because of truancy. He refused to respond to conferences, his family did not cooperate. He has remained in OD, until close of investigation, and was at that point doing 6A work.
(8) L.W. German parentage. Male. White.	Grade 1B C.A. 6–11 M.A. 7– 6 I.Q. 108 Aud. 5 Vis. 4 Rev. 3 W.F.B. (1) 48 (2) 31 W.Cyl. (1) 251 (2) 92	Entered 1A: C.A. (after month in 1A was sent back to kindergarten for one year, then reentered 1A) 1B, 2A, 3A, 3B, 5A, 5A	When in 5A; C.A. 13–0. Remained OB for 2 years, then to continuation school. 9 months later sent back to OB but did not appear before close of investigation.	Intellectual deficiency. Perhaps develop mechanical skill.	C.A. 12–11 (5A) M.A. 11– 0 I.Q. 85.1 Aud. 5 Vis. 6 Rev. 3 W.F.B. (1) 23 (2) 19 (3) 20 H-A (1) 96 (2) 10 (3) 7 D.F.B. (1) 121 (2) 69 (3) 66 Sch. Profic.: 5A, except. Arith. 3–4	A mature adolescent boy. Healthy and well developed. Good initiative, persistence, distribution of attention. Poor memory spans. No interest in school work. Poor ability to organize material.

TABLE 14—*Continued*

Case	1st Grade Examination	Age Entered and Grades Repeated before OB Placement	OB Placement Grade, Age, and Term OB	Reasons for OB Placement	Examinations by Division of Special Education	Notes on Examinations and Supplementary Remarks
(9) D.A. Female. White.	Grade 1A C.A. 6–8 M.A. 6–6 I.Q. 98 Aud. 4 Vis. 0 Rev. 0 W.F.B.(1) 89 (2) 60 W.Cyl.(1) F (2) F Stopped by obstacles. Very shy or negativistic. Binet may be unfair.	Entered 1A: C.A. 5–10 1A, 1A, 2A, 4A	When in 4B. Remained in OB until close of investigation.	Limited ability and school retardation.	C.A. 11–3 (4B) M.A. 8–3 I.Q. 73 Aud. 5 Vis. 5 Rev. 2 W.F.B.(1) 25 (2) 18 H-A (1) F (2) F (3) F (4) 10	Child was slow in responses, showed very inferior comprehension. Seems to get ideas very slowly. Erratic in her responses, needs constant and vivid stimulation. Needs particular help in spelling, vocabulary building. Auditory imagery perhaps best. Needed much drill in fundamental arithmetic.
(10) G.D. U. S. parentage. Male. White.	Grade 1B C.A. 7–5 M.A. 7–9 I.Q. 104 Aud. 5 Vis. 5 Rev. 2 W.F.B.(1) 39 (2) 24 W.Cyl.(1) 96 (2) 86 Evidently cried in examination.	Entered 1A: C.A. 6–2 1B, 2A, 2B, 3B, 3B	When in 4B; C.A. 12–2. Remained in OB until close of investigation.	For restoration purposes. Needed individual attention. Perhaps for permanent placement.	C.A. 11–11 (4B) M.A. 10– 8 I.Q. 90 Aud. 5 Vis. 6 Rev. 3 W.F.B.(1) 27 (2) 26 (3) 14 H-A (1) 99 (2) (3) o.k. D.F.B.(1) 127 (2) 67	Boy showed poor judgment when left to his own devices. Does not apply himself; described as a "silly, ineffectual type of boy." Seemed to have no opinions of his own. Is dependent, likes to be helped.

TABLE 14—*Continued*

Case	1st Grade Examination	Age Entered and Grades Repeated before OB Placement	OB Placement Grade, Age, and Term OB	Reasons for OB Placement	Examinations by Division of Special Education	Notes on Examinations and Supplementary Remarks
(11) G.T. U. S. parent- age. Male. White.	Grade 1B C.A. 7–7 M.A. 7–0 I.Q. 92 Aud. 5 Vis. 5 Rev. 0 W.F.B. (1) 87 (2) 73 W.Cyl. (1) F (2) F An unpleasant looking child. Seemed frightened; was unmanagable.	Entered 1A: C.A. 5–9 1A, 1B, 1B, 2A, 3A, 3B, and spent one term in restoration class.	When in restoration class. C.A. 12–9. Remained until 16 years of age, then dropped out.	(Was placed in OB by his school 7 mos. after this examination.)	C.A. 12–2 (4A) M.A. 11–0 I.Q. 90 Aud. 5 Vis. 7 Rev. 4 W.F.B. (1) 28 (2) 26 (3) 22 H-A (1) 160 (2) 85 (3) 20 (4) 7 D.F.B. (1) F (2) F Sch. Profic.: Reading 4th Arith. 3–4th	Recommended in first examination that he be placed in restoration class, with view of placing him ultimately in OB or in regular grade. An alert, careless boy. Poor habits of work. Poor in arithmetic fundamentals. Poor comprehension but good initiative and energy. Needs to be kept busy and thus out of trouble.
				Manual work, particularly in carpentry, should be stressed, in the OB class in which it is recommended he be retained.	C.A. 15–7 (OB) M.A. 12–2 I.Q. 78 Aud. 6 Vis. 7 Rev. 4 H-A (1) 140 (2) 60 D.F.B. (1) 270 (2) 60 Sch. Profic.: Reading 5A Spelling 4B–5A	Boy appeared very conformed, cooperative. Slow in responses. Showed good ability to follow directions, trainability. Work is neither accurate nor efficient. Intellectually retarded. Wants to be a carpenter. He should be allowed to leave school as soon as the law permits.

TABLE 14—*Continued*

Case	1st Grade Examination	Age Entered and Grades Repeated before OB Placement	OB Placement Grade, Age, and Term OB	Reasons for OB Placement	Examinations by Division of Special Education	Notes on Examinations and Supplementary Remarks
(12) M.D. Female. White.	Grade 1A C.A. 6–6 M.A. 5–9 I.Q. 88 Aud. 4 Vis. 0 Rev. 0 W.F.B. (1) 65 (2) 42 W.Cyl. (1) F (2) 222 "Rather dull. Infantile. Stammers. Motivation poor."	Entered 1A: C.A. 5–8 1B, 2B, 2B, 3A, 3A, 3B, 4B	When in 4B; C.A. 13–4. Remained OB until close of investigation.	Was doing unsatisfactory work in her class and needed much repetitive drill. (*Was not placed after this examination.*)	C.A. 8–11 (3A) M.A. 8– 0 I.Q. 90 Aud. 4 Vis. 4 Rev. 2 W.F.B. (1) 38 (2) x (3) 28 H-A (1) (2) (3) F (4) 29 (5) (6) (7) F Sch. Profic.: Reading: 2nd Slow	Unable to count by 1's to 100. Poor, slow reader. Much trial and error in performances, and inability to profit therefrom. Deficient energy. Poor visual imagery. Narrow memory spans.
				Needed special class instruction (was not placed until 2 years and 5 months after this recommendation.)	C.A. 10–11 (3B) M.A. 8– 0 I.Q. 73 Aud. 4 Vis. 4 Rev. 2 W.F.B. (1) 31 (2) 18 (3) 15 (4) 18 H-A (1) F (2) 8 (3) 9 (4) 8 D.F.B. (1) F (2) F Sch. Profic.: Reading 2nd Spelling 2nd Arith. 1st (?)	Tried very hard on all tests. Slow in responses. Memory span narrow. Poor ability to make fine discriminations. Good willingness and persistence. Imagery poor. Vocabulary very poor. Needs to have number concept established. Concrete material should be used for this.

TABLE 14—*Continued*

Case	1st Grade Examination	Age Entered and Grades Repeated before OB Placement	OB Placement Grade, Age, and Term OB	Reasons for OB Placement	Examinations by Division of Special Education	Notes on Examinations and Supplementary Remarks
(13) O.N. U. S. parent- age. Male. White.	Grade 1A C.A. 6–8 M.A. 6–9 I.Q. 101 Aud. 4 Vis. 0 Rev. 0 W.F.B. (1) 200 (2) 205 W.Cyl. (1) 45 (2) 30 "Very large head. Bad tonsils and adenoids. Bulgy eyes. Slow and lacks energy."	Entered 1A: C.A. 5–9 1B, 2A, 3A, 3B (2 mos. in restoration class) (one term in summer school) 6A	When in 6A; C.A. 14–4. Remained at close of investigation.	(Recommended placement at first examination but not followed.)	C.A. 10–1 (3B) M.A. 9–6 I.Q. 94 Aud. 4 Vis. 5 Rev. 3 W.F.B. (1) 28 (2) 19 (3) 15 H-A (1) 157 (2) (3) (4) F (5) (6) o.k. D.F.B. (1) 180 (2) 75 Sch. Profic.: Reading 1B Spelling 1B Arith. 3B	Good effort on all tests. Responds to encouragement and praise. Evidently a "nuisance" in class room, because he is inattentive and careless. Can not deal with abstractions. Needs much extra help in spelling and reading. Recommended OB placement.
				Placement in OB center where he can be taught "6th grade minimum essentials."	C.A. 13–11 M.A. 10– 7 I.Q. 78 Aud. 4 Vis. 6 Rev. 3 W.F.B. (1) 20 (2) 19 (3) 13 H-A (1) x (2) 7 (3) 10 D.F.B. (1) 62 (2) 45 (3) 44	Boy is excessively tall, thin, angular. Appearance undoubtedly makes difference in attitude toward others. Lisps. Now a "tall, narrow head." Is careless and inattentive in class. "Not bright enough to work steadily. Auditory imagery is poor. He is efficient and skillful at work with his hands; should make a good plumber, painter, paperhanger. Very poor at following written or oral directions."

Summary

As the result of the data presented in this investigation, these conclusions are indicated:

(1) The attempt to follow up by means of school records 416 children who had been given psychological tests in the first grade resulted in the accumulation of data for 78 per cent of the cases. Indices of Progress calculated only for those cases for whom record of at least twelve semesters in school could be located—55 per cent of the total group—distributed in a fairly normal way. The average Progress Index is about 90, which means that the average child takes about ten years to do the work of nine grades. The standard deviation from this average covers roughly more than one grade more or less than nine in ten years of schooling.

(2) In terms of first-grade I.Q. the followed up group was found to be superior to the original group of 500 first-grade children. The selection thus shown to be operative was difficult of explanation. It is possible that the children followed-up represented the superior schools of those used in the first-grade standardization. This, however, is not indicated in the results, and is only a possible explanation.

(3) The inclusion of zero scores in reverse and visual memory span tests lead to a tendency of bimodality in distribution. It would seem that the score of "0" should represent an inability to score on the test rather than a zero amount of ability either to give back a series of visually presented discrete units, or to reverse the order of such a series presented auditorially.

(4) By reducing the time limit for the Witmer formboard for first-grade children to two minutes, 7 per cent of cases in the distribution for the first trial and 2 per cent of cases in the distribution for the second trial are eliminated. For practical purposes of quantitative measurement on this test, the time limit may well be reduced without injuring the normal distribution of time-scores. The children thus eliminated may, however, be of greatest interest in qualitative clinical study.

(5) The Witmer cylinders test, since it does not distribute in normal fashion for children at the first grade level, is a poorly calibrated instrument of quantitative measurement at that level.

(6) There appears in correlation to be very slight relationship between the first trials of the performance tests and any other tests. The first trial of the Witmer formboard correlates to some degree with the second trial; this is not true of the trials on the cylinders.

(7) Auditory, visual and reverse memory spans appear to relate to each other to a fairly high degree. Probably they measure common factors.

(8) For the purposes of measuring relatively unrelated traits, abilities or factors at the first-grade level, a battery of tests including Stanford-Binet I.Q., memory spans and performance tests (the Witmer formboard and cylinders) is well suited.

(9) There is a positive relationship between the Stanford-Binet I.Q. and school progress, as well as between memory spans and school progress. The relationship of the former is somewhat greater. There is no such relationship between performance tests and school progress.

(10) The relationship stated in (9) is not of sufficiently high degree to warrant accurate prediction for school progress solely on the basis of the first grade test scores used in this study.

(11) There is a relationship between I.Q. secured on an individual test in the first grade, and that secured on a group test in the sixth and eighth grades. This relationship is greater than is the relationship between either of the tests to school progress.

(12) The I.Q. given in the later grades appears to be significantly lower in average than that given in the first grade, and to be more variable.

(13) Factors such as language handicap, environmental differences, and similar schooling were not controlled in this experiment. In addition, different tests were used in the first and later grades. Hence the reliability of statistical comparisons between I.Q. at the two levels is open to question.

(14) The type of examination given in the first grade to the children who achieved special class status in the schools at any time did not warrant prediction of such placement.

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